# The Earth Science DIGEST

25¢

MARCH 1948

# The Earth Science Digest

**Revere, Massachusetts**


*A magazine devoted to the advancement of the geological sciences.*



THE EARTH SCIENCE DIGEST is open to articles of geologic interest. Manuscripts, photographs and sketches will be returned if accompanied by ample first-class postage.


Subscriptions: 1 year, $2.00; 2 years, $3.75, 3 years, $5.00. Single Copies, 25 cents.





Published monthly by the Digest Publishers Company, 77 Victoria Street, Revere, Mass. Application for entry as second-class matter is pending.

**S. ALBERT EISENBERG, Publisher**
**GERTRUDE ROBERTS, Business Manager**





**Vol. II March - 1948 No. 6**


## Contents

# THE GIANT SLOTH
## (COVER PHOTO)

The excavations at the La Brea tar pits of the giant sloth revealed that the animal had a pelvic bone which measured three and one-half feet across, and paleontologists believe, therefore, that the animal must have been at least twenty feet in length. The huge bony structure of the animal appeared as a malformation, indicating that the sloth could have been impeded by its excessive weight and ungainly size. However, these handicaps apparently did not restrict its wandering in search of food and suitable habitat.

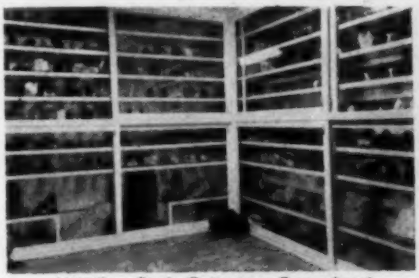
The enemies of the giant sloth were predatory animals such as the Dire wolf and the sabre-tooth cat, but an attack upon a sloth was often tragical. The sloth protected itself by utilizing its front limbs, exercising tremendous strength in fighting. In the hands or paws of the animal were long claws, and the sloth used them effectively for defense. The physical characteristics of the sloth were symbolic of its power.

Often one of the characteristics of power saved the animal from a fatal attack by an enemy. Nodules of bone were distributed and embedded deeply in the layers of skin throughout the body of the naimal. This mass of irregularly-shaped bones acted as an armor, discouraging neck and body attacks. Although the skin or hide of the giant sloth was not preserved by the tar, great quantities of nodules of bone were unearthed, having been found within the immediate vicinity of the larger remains.

The knowledge of the giant sloth was augmented several years ago by the discovery of the remains of a sloth similar to the giant sloth in Patagonia, a country that no longer exists since its division in 1881 between Argentina and Chile. While the giant sloth of the tar pits grazed the grasslands of the West, it wandered as far to the North as the Klamath River region (N. W. California to S. W. Oregon), seeking better pastures until the ice drove it south to extinction.

—Dewey Wendell Linze.



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*The Earth Science* **DIGEST**

REVERE, MASSACHUSETTS

# NOW THEY ARE GONE

## California Tar Pits Supply Paleontologists with Data on Ice Fauna

Even today small birds and ground squirrels become entrapped in the largest of these deceptive asphalt pits.

DEWEY WENDELL LINZE

If William Henry Seward had been alive five hundred thousand years ago, he might have never had to contend with public ridicule because he purchased what was known ironically as "Seward's Icebox." The Ice Age had its paradoxical beginning, and, until twenty thousand years ago, long stretches of ice covered the northern part of the world. Vegetation was frozen and destroyed. Animal life struggled to survive extinction.

The ice sheet that spread over North America forced the fauna to abandon habitats and flee southward, where, for the herbivores, there were better hunting grounds. Unfortunately, the meat-eaters outnumbered the plant-eaters by a very large margin, and, theoretically, this condition hastened the extinction of the Ice Age fauna. The meat-eaters attacked and killed those plant-eating animals which did not escape starvation, and as the herbivores decreased, the carnivores became hostile among themselves; they too, passed out of acitivity. Before the warm weather returned to North America, the fauna which had lived during the Pleistocene period were extinct.

This picture provides the reader with a precise concept as to how the fauna remains lie in the asphalt.

However, the skeletons of these animals which had been translocated by the glaciers have been exhumed in different regions of the Middle West, providing accurate knowledge and proof for their existence. Another source has been the La Brea tar pits which are located in the suburbs of Los Angeles, California. The remains, found in large deposits, are estimated to have been in the pits during the Ice Age and possibly before.

Asphalt has been the excellent preservative for these animal remains, and only the imagination can account for the deposits which were found to a depth of fifteen feet in the pits of oil and sand. There are no facts recorded in regard to an eye-witness description of the battles for life which are assumed to have taken place in the pits. The cave man held little concern since the animals were his greatest fear. Figts for survival must have occurred, for fauna remains from the Pleistocene time have been excavated by the thousands.

How this oily mixture preserved the bones is a remarkable feat of nature. The tissues, of course, have decayed, but the skeletons remain almost perfectly intact. Teeth and the most intricate bone structures were unimpaired by the passing of time. Some of the bones were marked with abrasions, and the probability again arises that the animals fought while they were caught in the tar. The antithesis of this could be that the animals entered the pits to devour the decaying forms of animals which had become entombed in the pits to die eventually, but which did not sink below the surface of the tar.

The Imperial elephant, which stood above the African elephant by five feet, was the largest animal ever trapped by the tar. The complete

Asphalt preserved these mastadon remains. The socket bone pictured was near the size of a bowling ball.

skeleton of this animal was never found, for the clay and sand in the asphalt caused an early deterioration of these skeletal parts. The remains of the mastadon have not been unearthed in entirety, for the same soil that caused the decay of the remains of the Imperial elephant also destroyed those of the mastadon. The mastadon differed from the modern elephant by the peculiarity of its molars.

Bison found upon game reservations today are comparable with the Pleistocene bison, but the Ice Age animals were half again as large.

Giant sloths seemed to be the most extraordinary of the extinct fauna. The remains of these animals have been taken from the asphalt in near-perfect condition. They are believed to have migrated from the southern part of North America. Their representative in the modern animal world is the Texas armadillo, although the Ice Age sloth was built massively, suggesting ample strength to crush its enemies. (See cover photo.)

The antelope was another victim of the tar pits, but that species was different from the antelope of today. A complete skeleton of this animal has been excavated from one of the tar pits, and the skeletal parts introduce the possibility of the animal's grazing off the grasslands of the west.

Camel remains have been dug from the asphalt, successfully proving that there were camels in America at one time. The remains resemble those of the camels which now dot the Great Desert in northern Africa. A touch of humor is not amiss while experts in Paleontology try to solve the problem as to whether the camels had one hump or two.

Approximately fifteen hundred separate skeletons of sabre-tooth cats have been removed from the pits. The remains of these animals exhibit the power and strength that made them superior in fighting in close quarters. Their neck and shoulder bone structures imply tremendous muscular ability. The jaws of the animals opened wider

A view of the bone deposit after partial excavation. Although the asphalt was removed there was always a continuous seepage which refilled the diggings.

than the jaws of any other animals of that type. Sabre-like teeth were from five to six inches long, having minute separations near the apexes. The teeth curved slightly toward the bottom of the mouths of the cats and were flat transversely. (Editor's Note: See-A Marsupial "Tiger" Is Found in Nebraska, by H. P. Zuidema, in the August 1947 *Earth Science Digest* for a comparison of these animals with the recently discovered marsupial sabre-tooth tiger.)

The Ice Age Dire Wolf was actually a wild dog. It resembled the hyena, but was of no relation. The head of the animal was thick and bony in structure, holding a very small brain. The small brain conceived ferocity, and in a melee the animal was deadly, for one would assist another. The Dire wolf was not built to pursue its prey, because its legs were short and thin; its feet were tiny, completely out of proportion with its shaggy body.

Animals of many species have been dug from the tar pits, including the tapir, whose nearest living ally is the horse. The Ice Age lion was one third larger than the lion of today, and twenty skeletons of this animal have been taken from the tar. Countless smaller beasts and birds of prey were swallowed by the tar. Remains were removed later in many excavations under the guidance of the Los Angeles County Museum.

Only nine per cent of the fauna remains taken from the pits were of the plant-eating variety, while ninety-one per cent were meat-eaters. According to a paleontologist under whose supervision the first of the excavations was successful, "The

Above is the skull of a saber-tooth cat which met death in the pit. The skull is lying in the asphalt up-side down.

presence of so many carnivores is explained by the fact that the cries, or smell, of a single mired animal might attract, for example, a whole wolf pack." This probably accounts for the great number of carnivores remains. The animals roamed southward in search for food and shelter, leaving a desolate and frozen land to the north. The warm climate of the western plains lured and held them until they became extinct.

The data, concerning Ice Age fauna, gathered by paleontologists in the removal of remains from the tar is almost as accurate and precise as the facts recorded by zoologists on the animals of today, but there is nothing that can reveal factually as to how many Ice Age fauna died in the pits of tar.

(Information for this article was compiled from clippings of the *Los Angeles Times* and data gathered by the Los Angeles County Museum.)

## TO OUR READERS

We wish to apologize to our readers for the delay of both this and the previous issue. Due to the difficulties involved in the moving of the editorial offices from Ann Arbor, Michigan, to Revere, and the delay in the shipment of the business files from Omaha, Nebraska, it will be at least a few weeks before the regular schedule can be resumed. We hope that our readers and advertisers will bear with us during this time.

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"Nothing - not the wind that blows
Was more unstable than the crust
of earth."

—ALFRED NOYES.

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## MINERAL QUIZ

The following mineral specie names were taken from a Scottish text on mineralogy published 75 years ago. How many of these can you identify?

1. Soapstone
2. Green-earth
3. Cyanose
4. Platina
5. Stibine
6. Emerald-nickel
7. Calaite
8. Pechurane
9. Kupferindig
10. Arsenic-antimony
11. Meerschaum
12. Kerate
13. Pipestone
14. Pollux
15. Castor

Answers and their explanations on page 29.

## LETTERS TO THE EDITOR

Dear Sir:

I have already received a couple of issues of the Earth Science Digent, and have enjoyed them very much. I think they are very valuable to a person who is deeply interested in Geology and Mineralogy.

E. J. Mimnaugh, Jr.
Spokane, Washingtton

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Dear Sir:

I look forward to each issue of the Digest and am much pleased with it. However, I don't believe it does what it was originally supposed to do.

May I quote from the Dec. '47 issue. These words appeared at the head of the editorial on page 15. "How can appreciation of geology be widened and deepened among the amateur and hobbyist?"

Wasn't the purpose of your magazine to do this very thing? But do you?

What I would like and probably most other amateurs would like are more articles about things that we ourselves can do. Stories on where to find different rock formations, fossils, identifying them, etc., are the type of things I would like to see.

A possible example might be an article on "micro-geology", looking at small things through the microscope. A piece of coal can be ground down so that it may be viewed through a microscope, revealing a whole new phase of Geology.

Please understand that I like many of the articles very much. It's just that the others are over my head.

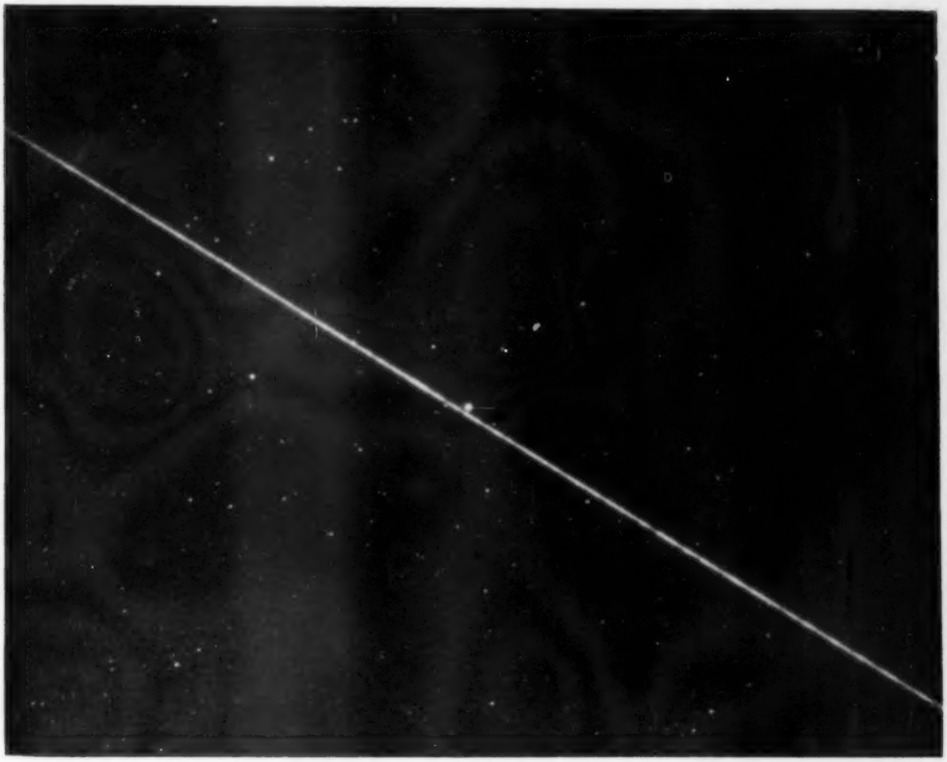
Please allow me to send my best wishes to you and your magazine in this new year.

Philip Sherman.
Hinsdale, Illinois.

# MINERALS—LITERALLY "OUT OF THIS WORLD"

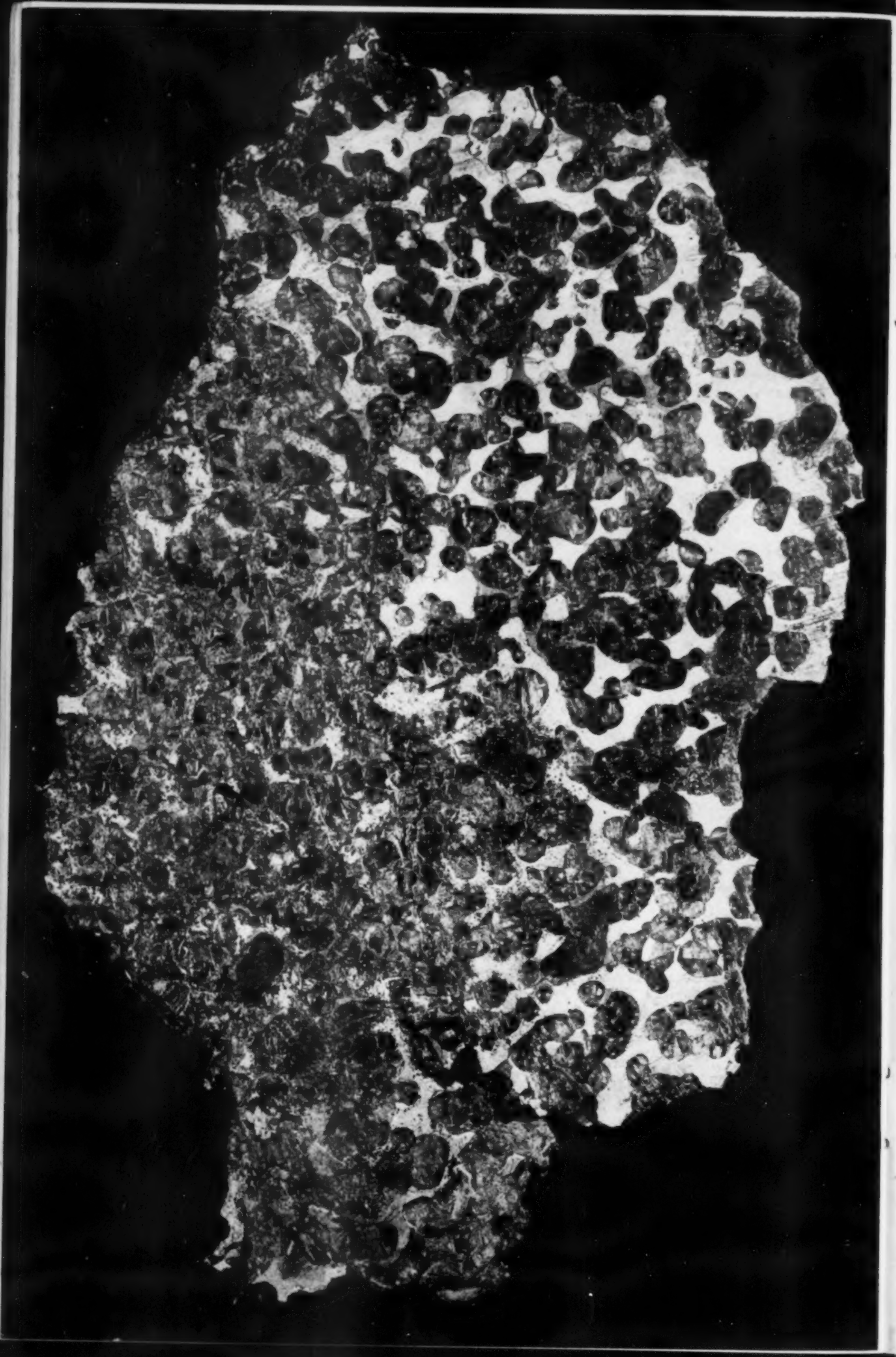
Reprinted from "The Pick & Dop Stick", official organ of the Chicago Rocks & Minerals Society.

CLELL M. BRENTLINGER



**The central portion of a meteor.**—Harvard Observatory Photo by Prof. L. A. Brigham.

Why do so few of us have in our mineral collections only a meagre representation, or none at all, of meteorities, one of the most interesting types of minerals extant? Probably the almost unanimous answer is: "They're so expensive". Why should they be probibitively priced and sell by the gram or ounce? The price, just as in all normal situations, is the result of supply and demand. Meteoritic specimens are scarcer than sugar or gas stamps were during rationing, and much harder to counterfeit. Although millions, or according to some authorities a billion meteoritic particles, strike our atmosphere daily, only an estimated thousand survive their atmospheric plunge and strike the surface of the earth. By probability, three-fourths fall in the oceans, and many more in isolated areas. Even those falling in more or less populous places are difficult to locate, so that only about three per year are actually recovered. But if they are too rare for our collections, we can at least know something about them.



*In starry flake, and pellicle*
*All day the hoary meteor fell".*
Whittier — "Snow-Bound".

To the practical mind this may seem a wild flight in poetic license, at lease until the source is noted. Then we begin to wonder about the connection between a meteor and a snow storm

A METEOR is defined (Webster's Collegiate Dictionary) as "any phenomenon in the atmosphere as whirlwinds, hail, rainbows, halos, shooting stars, etc." However, the definition of METEORITE is much more restricted—"A metallic or stony body that has fallen to the earth from outer space". A hailstone that falls to the earth then is produced by a meteor, but is not a meteorite since it is not stone or iron and does not come from outer space. And, a meteorologist predicts showers of rain rather than of metal or stone.

That meteors belong to the solar system is quite widely agreed, but there is no generally accepted theory as to their source or the method of their formation. They exhibit characteristics that belie an earthly origin. It is evident that they did not shoot out from the sun at least in their present form, for the heat would have vaporized them as they emerged. They move in orbits like comets, and for this and other reasons apparently are either the products of comets, or had a common origin with comets—which after all does not tell us much; comets too present unsolved problems to the astronomer.

At any rate meteors travel in interplanetary or perhaps even interstellar space until by chance they become entagled with the gravitational influence of say the earth and plunge "downward" in answer to its summons. Striking the atmosphere at a velocity of 7 to 25 miles a second, they become incandescent at a height of perhaps 75 miles. If not consumed by heat and friction they are visible until slowed down by air resistance to a velocity where the friction no longer causes incandescent heat, and they fade from sight. This generally is at a height of 25 to 50 miles. The path of visibility—and the path itself may be and remain visible for many minutes due to residue burned off and left as a luminous or smoky trail—may be hundreds of miles long, if the angle of incidence is small. One well observed path was 500 or 600 miles in length, crossing several states.

The apparent speed of the meteor may be slow or fast, depending on its velocity, the angle of incidence, and the time of day. If a meteor strikes the atmosphere in the early morning, when we are on the "front" side of the earth in its orbital travel, the 18 miles per second of the earth's speed is added to the meteor's velocity, and the resultant relative speed is much higher than it would be in the evening, when we are on the "rear" and the meteor would have to catch up on us.

In any event, whether they catch up with us or strike head-on, most are consumed, and as indicated above only a few of those are recovered for study. The vast majority of the billion, more or less, that strike the earth every day are mere grains of sand and burn up in the upper atmosphere. Only those weighing at least several ounces have enough substance to survive the fiery plunge and reach the earth. One might wonder what becomes of the material burned off as these objects, large and small, rush through the atmosphere. Actually such dust does fall

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**A slice of the Brenham (Kiowa Co., Kansas) Meteorite. This iron-stone meteorite weighed 1226.8 grams. In the cellular iron matrix are numerous chondrules of some of the silicate minerals, probably for the most part chrysolite.**—American Museum of Natural History Photo by Thane L. Bierwert.

and can be detected in undisturbed spots as for example the bottom of the deep sea. However, the total accumulation of meteoritic material since the earth was formed would amount to a layer of only a centimeter or so in thickness, if evenly distributed and undisturbed and undiluted.

There are two main types of meteorites, stone and metal, with in between combinations in all proportions. The stony variety generally consists of spherules or *chondrules*—pellets of stone of various sizes and in a form not known in any terrestrial substance, and comprised largely of silicates of magnesium—estatite and chrysolite, with some mineral compounds that do not occur terrestrially, for example schreibersite (an iron and nickel phosphide), cohenite ( a carbide of iron and nickel), and cohenite (a calcium sulfide). These stony meteorites ordinarily contain metallic particles in varying sizes and quantities, mixed through the stony material like raisins in a cake. Generally stony meteorites are greyish and rock-like in appearance, and—of interest to the lapidists among our readers—will take some polish.

The metallic meteorites are generally nickel and iron in varying ratios, mostly 75% to 90% iron. They take an excellent polish, and when polished surfaces are etched with dilute nitric acid they generally exhibit a characteristic pattern of markings called *Widmanstatten figures.* These figures vary greatly in different meteorite specimens, though they are uniform in any one fall. Some falls show a strong pattern of wide bands, while others show narrow bands, or thin lines, or even no markings at all. The bands indicate octahedral crystallization, and their width seemingly is a function of the nickel content—the more nickel the narrower the figures. However, and in apparent contradiction, some authorities at least have found that if the percentage of nickel is quite small, fine lines instead of figures are present. These lines are at right angles, like the edges of a cube. Probably the bands or lines depend not only on the ratio of nickel and iron but also on the temperature or other conditions present when the crystallization took place. The figures or lines are dimmed or eradicated by heating the specimen.

Our collection contains a meteorite cabochon, which is highly polished and very striking in a silvery, metallic fashion. Though mounted in a ring setting, it does not lend itself to wearing as jewelry, because of its tendency to rust. However a cabochon of meteoritic iron would grace any collection, and lend romantic interest at the same time. The grinding and polishing process is the same as for a stone cabochon, and a film of oil or laquer is recommended as a "preservative" for the high polish.

In addition to the non-terrestrial mineral compounds mentioned above, meteorites contain 40 or more elements, some well known but many of them uncommon or even very rare. A few such are arsenic, cadmium, carbon (microscopic diamonds), cobalt, indium, mercury, palladium, platinum, tellurium, thulium, and zirconium.

The exteriors of both stony and metallic meteorites show a characteristic pitted surface or thumb-print aspect, due to the burning or tearing away of the molten surface as the object falls. Many of them explode due to the heating of the surface, and sometimes successive explosions are heard and later substantiated by different degrees of "burning" on the fractured surfaces.

The flight of a bright meteoritic fireball, by day or night, is a rare and wonderful spectacle, generally thought by its beholders to be very near them, when in fact it may be a hundred or more miles away and fifty miles in the air. Recovery of even observed meteorites is difficult for this very reason, as all observers, perhaps hundreds of miles apart, are each sure the object fell "in the next field". This is especially true if the phenomenon is, as often happens, followed by a terrific roar and deafening explosions.

Contrary to common belief, meteorites are not hot when they strike the earth. They do not start fires, and incidentally there seems to be no authenticated case of a fatality due to a human being struck by a meteorite. Any small body wandering in interplanetary space is necessarily at the low temperature of its environment, and the brief period of frictional heating while falling is so short the heat does not penetrate very far. While a meteorite immediately recovered may be very warm, it is likely very soon to be cold and frost-producing because of the very cold interior.

Though more stone than iron meteorites fall, estimates varying from ten to one to thirty-five to one, chances of recovery are in favor of the iron variety because of their more recognizable characteristics. Many of the recoveries are due to the interest and perseverance of scientists, particularly men like Dr. H. H. Nininger, formerly of Denver and now established in his own museum (The American Meteorite Museum) on Highway 66 near Meteor Crater, Arizona.

Dr. H. H. Nininger examining an iron meteorite which had just arrived from Australia.

My wife and I recently visited this unique museum, and having introduced ourselves as interested in meteorites we were given a hearty welcome by both Dr. and Mrs. Nininger. They told us of visitors almost around the clock—some interested in meteorites and others thinking the museum is a new tavern.

The museum, housed in a new and attractive building constructed for the purpose, contains Dr. Nininger's personal collection of meteoric material—and do not let its personal ownership mislead you—it compares favorably with that in any public museum. In fact Dr. Nininger told us it is one of the four major collections in the world. He has a small fortune invested in the cutting and polishing of meteorite surfaces, and one does not begrudge the small admission charge, which we hope will to some extent at least reimburse the Niningers for their scientific investment. Do not miss this museum if you travel Highway 66, and while we are plugging "let us

A view of the elevated rim of Meteor Crater, Arizona, from a distance of about two miles.
—Photo by Clyde Fisher.

A view of Meteor Crater, Arizona, from a plane. The San Francisco Peaks can be seen in the background. The entire landscape was covered with snow when this picture was taken in midwinter.—Photo by Clyde Fisher.

suggest you call on Bill Stambaugh in Flagstaff, who does a lot of meteorite polishing for Dr. Nininger and who, as several of our members will testify, has a wonderful stock of petrified rainbow wood. He and his charming wife and a young lapidary son will stretch your "call" into a visit in spite of your tight travel schedule.

You should also visit Meteor Crater, apparently a short hike from the Nininger museum, but actually five and a half miles away over a side road. This crater is four-fifths of a mile in diameter, and now only 600 feet deep — only because it was originally 1,400 feet, but the lower 800 feet have been filled with sand and other erosion material. This crater was made by a tremendous nickel-iron meteorite which fell perhaps 50,000 years ago. Authorities differ greatly on even the approximate size of this celestial visitor; in any event it must have presented a fearful and wonderful spectacle as it fell and struck the earth. A great deal of native rock was vaporized by the impact, and much was pulverized so you may even now collect an interesting specimen of "rock-flour" if you have a paper bag or a tin can. The injunction that no meteoric fragments are to be picked up seems unnecessary as all the surface fragments—thousands of them varying from pea-size to hundreds of pounds in weight and originally scattered over a wide area of surrounding desert—have long since been gathered up and placed in museums or private collections.

The main mass of the meteorite was long sought and is believed to have been located not at the bottom of the crater, but under the desert to the south. The round shape of the crater has misled the searchers and caused a lot of futile drilling. Too late for the original investigators someone discovered that a projectile makes a round crater even though it strikes at a low angle; this meteorite came from the north and lies hunreds of feet underground outside the crater ring.

It is interesting to note that a meteorite has been held in a court of law to be real estate and to belong to the owner of the land on which it is found, even though not imbedded in the earth. This was established in a suit over a metallic meteorite weighing many tons, which was hauled at great labor from its first known though not necessarily original location in the mountains of Oregon by two men possessed of more physical energy than knowledge of law, and recovered by the land owners after much litigation.

A recent fall, and evidently of even greater magnitude than the one at Meteor Crater, was in northern Siberia in 1908. Trees were felled like match sticks over an area of a hundred square miles, and though none of the few inhabitants of the sparsely settled area was within many miles of the strike some who were outdoors were knocked flat by the blast, which produced barometric and seismographic effects hundreds of miles away in England. Striking in our "Loop" instead of Siberia, this meteorite would have broken the "no fatality" record with the vengeance of a late model atomic bomb, with plenty of margin.

A still greater fall is believed by some scientists to have occurred prehistorically along the coastal plain of South Carolina and adjoining states, the theory being based on a series of craters the size and extent of which would make the Meteor Crater, or even the devastated Siberian area, dwindle into insignificance. There are tens of thousands of these so-called "bays", from a few yards to two or three miles in diameter. Perhaps the opponents of the meteoric theory of the origin of these depressions are right, but if they are not, let us hope we do not have a demonstration of their fallibility.

We will—if astronomically minded—be watching for one of the recurring meteoric showers, the Orionids, which "fall" for a couple of weeks in late October, apparently from the constellation of Orion. Such a shower may in the dark of the moon reward a watcher with perhaps twenty "shooting stars" per hour. Perhaps last fall you watched the Giacobinid shower, associated with the Giacobini-Zinner comet, which during the early evening of October 9th rewarded the watcher with a spectacle unmatched in our generation. Incidently your reward for watching such a shower will probably be more esthetic than practical, for you are not likely to get a meteorite for your collection just by watching a shower. Few if any meteorites that have fallen during meteoric showers may be purely coincidental and not connected with the shower at all.

The largest known meteorite is in its original location in Grootfontein, Southwest Africa. It is known as the Hoba West, and being about 9 by 9 by 3 feet and of a metallic nature it weighs some 60 tons. Better known than the Hoba West is the one weighing 36½ tons, brought from Greenland by Admiral Peary and on display in the American Museum of Natural History in New York.

Undoubtedly the best known meteorite in the world, though few of its "acquaintances" probably ever heard of a meteorite as such, is the Kaaba or Black Stone at Mecca, focal point of holy pilgrimages from all over the Moslem world.

The fine collection of meteoric material on exhibition in our own Chicago Natural History Museum surely merits at least a casual inspection if you happen to be visiting the gem room or mineral display. This exhibit contains a meteorite "in situ" as one might say, in the seat cushion of an automobile, where it came to rest after penetrating a garage roof, the top of the car, and the seat cushion, which it passed through, striking the gas tank below and denting it, after which it bounced back into the seat springs and lodged there. This is one of the few known "falls" in our own state, having occurred a few years ago at Benld, near Carlinville.

Meteorites afford the only tangible evidence of the whole of the universe outside our earth, and for that reason they have an emotional as well as scientific appeal. To actually possess or handle something literally from "out of this world" is an experience provocative of much thought and speculation.

References:

Back issues of *Sky* and *Sky and Telescope;* published by the Sky Publishing Corporation, Harvard College Observatory, Cambridge, Mass.

*Meteorites,* by Oliver C. Farrington; Bulletin of the Field Museum of Natural History, Chicago, 1923.

*A Comet Strikes the Earth,* by H. H. Nininger.

(Editor's Note: *The Earth Science Digest* is deeply grateful to Prof. Fletcher G. Watson, of Harvard University, for his help in obtaining the photos used in the illustration of this article.)

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# WITH THE CLUBS

## THE GEORGIA MINERAL SOCIETY

The Georgia Mineral Society met February 5, 1948, in the Blue Flame Room of the Atlanta Gas Light Company, Vice - President Garland Peyton presiding. Dr. R. A. Kirkpatrick, who addressed the Society last year on Boulder Dam, spoke again on "California", using colored lantern slides to illustrate his lecture.

The first meeting of the Gemmology Section of the Georgia Mineral Society was held on February 23rd. This section of the Society, its first one, is proving to be very popular, and already has a large enrollment. Members of the Society in good standing are eligible to join upon payment of 50c dues.

Dr. Horace G. Richards will be the guest speaker at the Society's March meeting.

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## POMONA VALLEY MINERAL CLUB

The Pomona Valley Mineral Club had as speaker at its February meeting Mr. Hollis Page. He showed colored motion pictures of a recent trip through Oregon, Washington, and Montana. He told of the old mining towns and mines he visited.

After his interesting talk, the Club held its annual auction of minerals and cut and polished specimens, which were contributed by the members. Door prizes were won by Mrs. Kroger, Mrs. Kryder, and Mr. Smith.

On February 29, the Club is to go on a field trip to the Metropolitan Water District's Softening and Filtration Plant at La Verne. This trip is being arranged by Mr. Page.

## THE CHICAGO ROCKS AND MINERALS SOCIETY

An illustrated lecture by Edwin Goff Cooke on "The Archeology of Lesser Known Places in the Southwest" was given at the February meeting of the Chicago Rocks and Minerals Society. Mr. Cooke told of the soil erosion and geology in relation to the history of the early cultures of the region. Wupatki, Wukaki, Lumoki, Betatakin, Tsegi Canyon, and Walnut Canyon were illustrated with color slides.

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## THE OKLAHOMA MINERAL AND GEM SOCIETY

At the February meeting of The Oklahoma Mineral and Gem Society, a review of the history preceding the organization and drafting of the Society's charter was given by the Charter President Mr. J. B. Lankford.

The address of the evening was presented by Mr. George E. Smith, past president of the Society. Mr. Smith's topic for the evening was "Minerals of The Southeastern United States." Preceding the talk on the mineral possibilities was a brief geologic history of the development in this area which explained why the localities are so lucrative in mineral specimens. The subject was covered in a very comprehensive manner and excellently illustrated with maps and mineral specimens.

All visitors and interested persons are cordially invited to attend the Society's meetings, which are held the first Thursday of each month at an announced location.

## THE SAN DIEGO MINERAL AND GEM SOCIETY

The "San Diego Mineral and Gem Society" officially became the new name of the San Diego Mineralogical Society at the February meeting. The growing interest in lapidary work, as well as the natural heritage of San Diego County as the sixth greatest gem-producing area in the world, warranted the change. An attractive new insignia was designed by Mrs. R. F. (Stella Fay) James, a member of the Society's Lapidary Division. Homer Dana, assistant to Donal Hord, one of America's leading sculptors, discussed the sculpturing of "Thunder", a recently completed 104 pound statue made from one piece of Wyoming's Nephrite Jade. Large photographs depicted the steps in the work, from the crude block through sawing and grinding to the final finishing.

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## NEW MINERAL CLUB ORGANIZED IN NEW MEXICO

A new organization of mineral and artifact collectors was formed on January 23, 1948, at the residence of S. F. Sanders, of Brazito, New Mexico. It is composed of a group of residents of Brazito and nearby Las Cruces who, as an unorganized group, had previously designated themselves as "The Brazito Gang". Regular meetings will be held at the homes and business establishments of the various members on the second Friday of each month, and a schedule of field trips will be prepared in the near future. Membership is open to any residents of the Hatch, Las Cruces, Brazito, Mesquite, Berino area. Officers elected at the organization meeting were: President, Mrs. S. F. Sanders; Vice President, Edwin Archer; Treasurer, S. F. Sanders; Recording Secretary, Mrs. Louis Roberts; Corresponding Secretary, Don Alfredo. Correspondence and an exchange of ideas with other clubs is welcomed.

# GEOLOGY AND THE MICROSCOPE

(First of a Series)

An Introduction to Microscopical Geology

ARNOLD GOODMAN
Boston University

Geology's bond with the other sciences is close and interlocking. Geology, dynamical and structural, is dependent upon chemistry and physics, for all rocks and minerals have a chemical constitution and all dynamic operations are illustrations of physical laws. The earlier conditions of the globe are better understood and appreciated if the known facts of astronomy are used. Contributing largely to an understanding of historical geology, zoology and botany aid in the identification of animal and plant life of the past and help to trace their evolution to the present time.

Microanalytical methods, which are largely qualitative, permit the identification of animal and mineral substances by certain diagnostic histological characteristics and to confirm the identification by certain physical constants. The microchemical technique and the application of optical crystallographic methods in the identification of small quantities of crystalline material have drawn the workers in the different scientific and professional fields into a common goal leading to a greater appreciation of the world about us and the unity of the sciences.

The application of the microscope has been extended into almost every field; it is used in the testing laboratories of manufacturing plants, in the research laboratories of chemical and pharmaceutical houses, and in the production line of industry. Chemists find it indispensable in the analysis of small quantities of unknown substances. By this means metallurgists study the grain structure of the metals. Bacteriology and cellular pathology owe their existence to the microscope. Conditions of the body can be diagnosed through microscopic examinations of the blood, urine, tissue, etc. The identification of pollens in allergy and of drugs in pharmacology and toxicology has been due in no small measure to interested pharmacists and chemists. Many of their methods can be utilized in our scientific fields.

Students interested in microscopy often use inexpensive lenses and simple microscopes which magnify specimens from 5 to 250 diameters. With some inexpensive equipment it is possible to gradually develop an interesting and valuable collection; in fact the hobby can well become a career. The average student's microscopic studies usually evolve in the same order as that of the early microanalyst's fields of activity, that is, the examination of specimens of food, vegetable and animal tissue, and finally drugs, both organic and inorganic. The study of the last field may lead the student far into the fields of minerals and rocks.

If we assume that most of the land areas, which comprise about three-tenths of the surface of the earth, have been explored, there remains buried beneath the waves the gretest unknown area of the earth. Magellan, during his famous round-the-world voyage of 1585, made the first deep-ocean sounding. Since then, the U. S. Coast and Geodetic Survey ships have brought up many samples from the ocean bottom. Now, vertical layers of the sediments, or call cores, have been brought to the surface, and studies have shown that the cores are a history of the latest geologic time which we are now just leaving behind. There is a much greater concentration of radium in the sediment of the ocean bottom than in the rocks on land, and of practical interest to us are the tiny particles of magnetic minerals that settled to the ocean floor a long time ago and which behave like little compasses. The tracing of climatic, magnetic, biologic, and chemical changes back into the remote past will be enhanced by the microscopic examination of the sediment.

We hope that through this series of articles the reader will be brought to realize the importance of microscopy and make use of it in his field.

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"When I have seen the hungry ocean
again
Advantage on the kingdom of the
shore,
And the firm soil win of the watery
main,
Increasing store with loss, and loss
with store;
When I have seen such interchange
of state,
Or state itself confounded to decay;
Ruin hath taught me thus to ruminate."

—Shakespeare, *Sonnet* lxiv.

# ALBARO ALONSO BARBA ON FOSSILS (1640)

(The following passage is taken from "The First Book of the Art of Mettals, In Which is Declared the manner of their Generation; and the Concomitants of Them." Written in 1640 by Albaro Alonso Barbara, Curate of St. Bernard's Parish, in "The Imperial City of Potosi, in the Kingdom of Peru in the West-Indies", it is an excellent example of the treatment given fossils by the early 17th Century writers. In the same work, Barba also attributes the formation of some of the fossils to "the influence of the heavenly bodies".)

When we meet with Stones, that represent Animals, or the limbs of them, or Plants, or other things not by superficial draught or coloring, but in bulk and substance: I believe it may arise from some petrifying liquor, which that matter has sucked into its pores, and thereby is become all Stone, and so thinks *Avicene*: but although sometimes this may be the cause thereof, yet methinks it cannot reasonable be supposed to be so always.

At the foot of the Mountains *Misnenses*, near unto the Lake of Alsacia, Stones are very commonly found that have embossed upon their superficies, the images of Frogs and Fishes in fine Copper. Anciently they were called a sort of Stone*Conchites*, which were in all their lineaments very like unto the Cockles of the Sea; and they thought that those fish shells lying a long time in soil, where much Stones were begotten, the petrifying liquor entering into the pores of the shell converted it into Stone: and they ground this opinion upon the certainty that the Sea in old time hath overflown the whole Territory of the City of *Magara*, where only these sort of Stones are found. But of later times all colour of reason is taken away from the forementioned conceit, by the wonderful veins of Stone, some grey, some Iron coloured, and some yellow, which are found in the high way, as one goes from Potosi to *Oronesta* down the Hill. There they gather Stones that have in them impressions of divers sorts of figures, so much to the life, that nothing but the author if nature itself could possibly have produced such a piece of workmanship. I have some of these Stones by me, in which you may see Cockles of all sorts, great, middle-sized, and small ones. Some of them lying upwards, and some downwards, with the smallest linements of those shells drawn in great perfection; and this place is in the heart of all the Country, and the most double mountainous land therein, where it were madness to imagine that ever the Sea had prevailed, and left Cockles only in this one part of it. There be also amongst these Stones the perfect resemblance of Toads and Butterflies, and stranger figures, which though I have heard from credible witnesses, yet I forbear to mention, and not to overburden the belief of the Reader.

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"There rolls the deep where grew the tree,
O earth, what changes hast thou seen!
There where the long street roars, hath been
The stillness of the central sea.
The hills are shadows, and they flow
From form to form, and nothing stands;
They melt like mist; the solid lands,
Like clouds they shape themselves and go."

—TENNYSON.

# THE COLLECTOR

*This section of the Earth Science Digest will be devoted to the collector of minerals, fossils, and rocks. Notes on collecting, collections, localities, etc., will be welcomed. Please address all correspondence to The Collector, c/o The Earth Science Digest, Revere, Mass.*

## A REPRESENTATIVE MINERAL COLLECTION

A list of important mineral species that should be in every serious collector's cabinets is given below. The compilation of this list was based upon those species most common in the United States, the more important economic minerals, and those minerals most often found in museums and private collections. Emphasis is placed upon species which illustrate the common physical properties of minerals, such as hardness, structure, cleavage, and specific gravity.

This list of 150 species is divided into six parts; the first part consisting of those species which the writer considers most important, the second part consisting of those next in importance, etc. Those collectors who buy a large part of their minerals will find this division helpful, especially if they purchase only a few species at a time. The importance of a knowledge of the properties and characteristics of the more important mineral species can not be overestimated in its application to actual collecting in the field.

(1)

| | | | |
|---|---|---|---|
| 1. Amphibole | 8. Dolomite | 14. Hematite | 20. Pyroxene |
| 2. Apatite | 9. Fluorite | 15. Limonite | 21. Quartz |
| 3. Beryl | 10. Galena | 16. Magnetite | 22. Serpentine |
| 4. Biotite | 11. Garnet | 17. Muscovite | 23. Sphalerite |
| 5. Calcite | 12. Gypsum | 18. Orthoclase | 24. Talc |
| 6. Chalcopyrite | 13. Halite | 19. Pyrite | 25. Tourmaline |
| 7. Corundum | | | |

(2)

| | | | |
|---|---|---|---|
| 26. Albite | 33. Bornite | 39. Copper | 45. Opal |
| 27. Anglesite | 34. Cassiterite | 40. Epidote | 46. Pyrrhotite |
| 28. Aragonite | 35. Celestite | 41. Graphite | 47. Siderite |
| 29. Arsenopyrite | 36. Cerussite | 42. Kaolinite | 48. Silver |
| 30. Azurite | 37. Cinnabar | 43. Malachite | 49. Stibnite |
| 31. Barite | 38. Clinochlore | 44. Microcline | 50. Sulfur |
| 32. Bauxite | | | |

(3)

| | | | |
|---|---|---|---|
| 51. Andalusite | 58. Franklinite | 64. Oligoclase | 70. Stilbite |
| 52. Anhydrite | 59. Ilmenite | 65. Phlogopite | 71. Tetrahedrite |
| 53. Chromite | 60. Lepidolite | 66. Rutile | 72. Topaz |
| 54. Chrysocolla | 61. Marcasite | 67. Scheelite | 73. Turquois |
| 55. Chrysolite | 62. Molybdenite | 68. Smithsonite | 74. Willemite |
| 56. Cuprite | 63. Nickel-Iron (Meteoric) | 69. Staurolite | 75. Zircon |
| 57. Cyanite | | | |

(4)

76. Amblygonite
77. Argentite
78. Brucite
79. Calamine
80. Chalcocite
81. Cryolite
82. Datolite
83. Goethite
84. Labradorite
85. Leucite
86. Magnesite
87. Molybdenite
88. Orpiment
89. Prehnite
90. Realgar
91. Rhodochrosite
92. Rhodonite
93. Spodumene
94. Titanite
95. Uraninite
96. Vermiculite
97. Witherite
98. Wolframite
99. Zincite
100. Zircon

(5)

101. Analcite
102. Anorthite
103. Anthophyllite
104. Alunite
105. Chabazite
106. Chrysoberyl
107. Colemanite
108. Collophanite
109. Diamond
110. Dumortierite
111. Enargite
112. Manganite
113. Natrolite
114. Nephelite
115. Pectolite
116. Psilomelane
117. Pyromorphite
118. Pyrophyllite
119. Prochlorite
120. Scapolite
121. Sillimanite
122. Spinel
123. Strontianite
124. Sylvite
125. Wulfenite

(6)

126. Antimony
127. Arsenic
128. Autunite
129. Carnallite
130. Carnotite
131. Columbite
132. Cristobalite
133. Dioptase
134. Embolite
135. Descloizite
136. Ferberite
137. Gahnite
138. Gummite
139. Huebnerite
140. Kernite
141. Lazurite
142. Mimetite
143. Monazite
144. Niccolite
145. Pentlandite
146. Phenacite
147. Sodalite
148. Soda Niter
149. Ulexite
150. Vesuvianite

—JEROME M. EISENBERG.

# THE JUNIOR MINERAL EXCHANGE

The Junior Mineral Exchange is a non-profit association, established in January, 1944, dedicated to the development of interest in mineralogy and the associated sciences among the younger generation. It is now sponsored by the *Earth Science Digest*.

Membership in the Junior Mineral Exchange is open to cellectors 13 to 17 years of age who desire to exchange both specimens and ideas with other collectors their age.

Dues are $2.00 a year. This includes a year's subscription to the *Earth Science Digest*, a membership card, and the Junior Mineral Exchange Bulletin, the official publication of the association, issued occassionally, which contains club news and a list of the new members.

To join, send your name, address, age, and the approximate size of your collection, if any, to the Secretary:

**William Tillman, 4141 Grayton Road, Detroit 24, Michigan.**

If you already have a subscription to the Earth Science Digest which has not expired, please do not enclose any dues.

## RECOMMENDED READING

*The Earth Science Digest* has selected the following articles from current periodicals as recommended reading. Abstracts of the more important articles are quoted.

### Physical Geology

"American and Eurasian Glaciers of the Past: A Picture Based on Existing Ones". William Herbert Hobbs. *The Scientific Monthly*, Vol. L X V I, No. 2 (February 1948), 99-106.

"Flying Bars". Robert L. Nichols. *American Journal of Science*, Vol. 246, No. 2 (February 1948), 96-100.

"Geological Significance of Meteorites". H. H. Nininger. *American Journal of Science*, Vol. 246, No. 2 (February 1948), 101-108.

"Plunge Pools, Potholes, and Related Features". Ronald L. Ives. *Rocks and Minerals*, Vol. 23, No. 1 (January 1948), 3-10.

"Origin and development of plunge pools, potholes, and related features are briefly outlined, with field examples; and their significance to the field geologist and mineralogist in sketched."

"The New Eruption from Hekla". Dr. G. W. Tyrrell. *Nature*, Vol. 161, No. 4080 (January 10, 1948), 41-32.

### Historical Geology

"Critique of the Time-Stratigraphic Concept". Harry E. Wheeler and E. Maurice Beesley. *Bulletin of the Geological Society of America*, Vol. 59, No. 1 (January 1948), 75-78.

"The Bright Angel group of the southern Great Basin region is defined as consisting of the predominantly argillaceous strata which lie between the underlying Prospect Mountain quartzite and overlying Middle Cambrian limestones. This lithogenic unit is shown to range in age from partly pre-Cambrian in the Nopah Range of southeastern California to entirely Middle Cambrian in the Grand Canyon of Arizona. The Bright Angel group illustrates the fact that the problems of stratigraphic classification are four-dimensional and, as such, are not amenable to treatment by the conventional dual system of stratigraphic nomenclature.

"The fact that rock units and unconformities may vary in age from place to place is determined as the sole factor demanding (1) a threefold nomenclatural system, and (2) abandonment of the concept that erosional breaks may serve as time-stratigraphic boundaries. This variation in age of lithogenic units is recognized as a fundamental truth in stratigraphy, nearly equal in significance to the laws of superposition and faunal succession, and is appropriately designated therefore as the *principle of temporal transgression.*"

"Geological Correlation and Paleoecology". Robin Sutcliffe Alan. *Bulletin of the Geological Society of America*, Vol. 59, No. 1 (January 1948), 1-10.

"It is argued that the criteria of correlation are logically vulnerable, and that the principles of stratigraphy need reformulating if the science is to regain its vitality and productiveness. Two possible lines of advance are indicated. The first, which may be called the paleoecological approach, involves the application of modern knowledge of sedimentation and ecology to stratigraphy and implies greater use of the facies concept. It is suggested second, that greater attention should be paid to the study of restricted groups or organisms as they evolve in time through strata of uniform lithology. Finally the possibility of linking lineage studies with facies-shift is pointed out."

"Ichthyosaur Ancestors". Alfred Sherwood Romer. *American Journal of Science*, Vol. 246, No. 2 (February 1948), 109-121.

### Economic Geology

"Native Rocks and Minerals as Fertilizers". W. D. Keller. *The Scientific Monthly*, Vol. LXVI, No. 2 (February 1948), 122-130.

### Mineralogy

"Simple Field Test for Distinguishing Minerals by Abrasion pH". Rollin E. Stevens and Maxwell K. Carron. *The American Mineralogist*, Vol. 33, Nos. 1 & 2 (January-February 1948), 31-49.



# ANSWERS TO MINERAL QUIZ

1. Talc. Named soapstone in allusion to its greasy or soapy feel.
2. Glauconite. This mineral is sometimes found as a green sand or earth.
3. Chalcanthite. From the Greek, (*cyano*, dark-blue; *gen*, producing), in reference to its color.
4. Platinum. From the Spanish, (*plata*, silver), due to its resemblance of silver.
5. Stibnite. From the name Pliny (A. D. 23-79) gave to this mineral (*stibi*).
6. Zaratite. From the color and composition of this ore.
7. Turquoise. Some believe that this was the *callais* of Pliny, which was described as resembling lapis lazuli, but being paler in color, perhaps the color of the shallow sea; hence the name calaite.
8. Uraninite (Pitchblende). In allusion to its pitch-like character and composition.
9. Covellite. From the German, copper indigo, referring to its composition (CuS) and color.
10. Allemontite. From its composition (AsSb).
11. Sepiolite. From the German for sea-foam, because of its color and lightness.
12. Cerargyrite. From the Greek for horn-silver, due to its resemblance of horn and its composition (Silver chloro-bromide).

14. and 15. Pollucite and Castorite (var. of Petalite). These minerals occur together, therefore they were named after the twin brothers Castor and Pollux of Greek mythology, famous for their brotherly affection.